5. Start with the area, and one side length.

a) $9c^2 \div 3c = 3c$

b) $(m^2 + 3m) \div m = m + 3$

c) $(2r^2 + 4r) \div 2r = r + 2$

10. a)

i) $\frac{12x}{2x} = \frac{12}{2} \times \frac{x}{x} = 6$

ii) $\frac{12x}{-2x} = \frac{12}{-2} \times \frac{x}{x} = -6$

iii) $\frac{-12x}{2x} = \frac{-12}{2} \times \frac{x}{x} = -6$

iv) $\frac{-12x}{-2x} = \frac{-12}{-2} \times \frac{x}{x} = 6$

v) $\frac{12x^2}{2x} = \frac{12}{2} \times \frac{x^2}{x} = 6x$

vi) $\frac{12x^2}{2x^2} = \frac{12}{2} \times \frac{x^2}{x^2} = 6$

vii) $\frac{-12x^2}{2x^2} = \frac{-12}{2} \times \frac{x^2}{x^2} = -6$

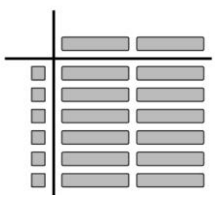
viii) $\frac{12x^2}{-2x^2} = \frac{12}{-2} \times \frac{x^2}{x^2} = -6$

b) Some quotients are equal because in fraction form they have the same numerator and denominator. The sign of the coefficient is the only thing that differs for some of the quotients.

c) Algebra tiles could be used for parts i through v.

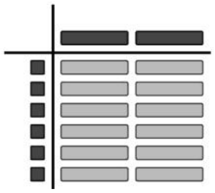
i) $\frac{12x}{2x}$

Arrange twelve x-tiles in a rectangle with one dimension $2x$. The guiding tiles along the other dimension represent 6.



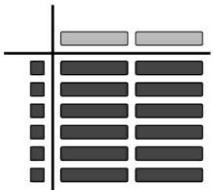
ii) $\frac{12x}{-2x}$

Arrange twelve x-tiles in a rectangle with one dimension $-2x$. The guiding tiles along the other dimension represent -6.



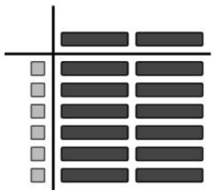
iii) $\frac{-12x}{2x}$

Arrange twelve $-x$-tiles in a rectangle with one dimension $2x$. The guiding tiles along the other dimension represent -6.



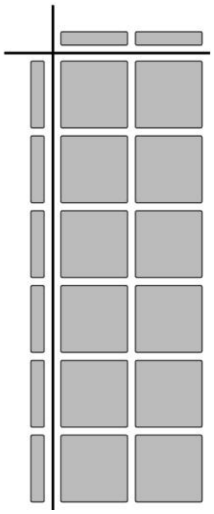
iv) $\frac{-12x}{-2x}$

Arrange twelve $-x$-tiles in a rectangle with one dimension $-2x$. The guiding tiles along the other dimension represent 6.



v) $\frac{12x^2}{2x}$

Arrange twelve x^2-tiles in a rectangle with one dimension $2x$. The guiding tiles along the other dimension represent $6x$.



11. a) $(2r)(-6r) = -12r^2$

b) $(-16n^2) \div (-8n) = \frac{(-16)}{(-8)} \times \frac{n^2}{n}$

$= 2n$

c) $(-5g)(7g) = -35g^2$

d) $\frac{40k}{-10k} = \frac{40}{(-10)} \times \frac{k}{k}$

$= -4$

e) $(9h)(3h) = 27h^2$

f) $\frac{48p^2}{12p} = \frac{48}{12} \times \frac{p^2}{p}$

$= 4p$

g) $18u^2 \div (-3u^2) = \frac{18}{(-3)} \times \frac{u^2}{u^2}$

$= -6$

h) $\frac{-24d^2}{-8d^2} = \frac{(-24)}{(-8)} \times \frac{d^2}{d^2}$

$= 3$

16. I expressed each quotient expression as the sum of fractions, then simplified.

a) $\frac{10x^2 + 4x}{2x} = \frac{10x^2}{2x} + \frac{4x}{2x}$

$= 5x + 2$

b) $(6x^2 + 4x) \div x = \frac{6x^2 + 4x}{x}$

$= \frac{6x^2}{x} + \frac{4x}{x}$

$= 6x + 4$

c) $\frac{6y + 3y^2}{3y} = \frac{6y}{3y} + \frac{3y^2}{3y}$

$= 2 + y$

d) $\frac{40x^2 - 16x}{8x} = \frac{40x^2}{8x} + \frac{-16x}{8x}$

$= 5x - 2$

e) $\frac{15g - 10g^2}{5g} = \frac{15g}{5g} + \frac{-10g^2}{5g}$

$= 3 - 2g$

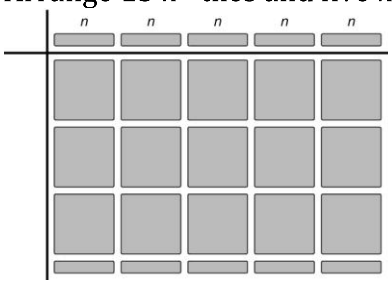
f) $\dfrac{-12k - 24k^2}{3k} = \dfrac{-12k}{3k} + \dfrac{-24k^2}{3k}$
$= -4 - 8k$

g) $(24h^2 + 36h) \div (-4h) = \dfrac{24h^2 + 36h}{-4h}$
$= \dfrac{24h^2}{-4h} + \dfrac{36h}{-4h}$
$= -6h - 9$

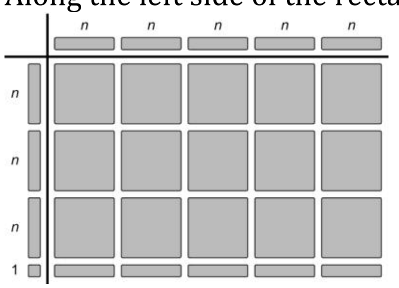
h) $(-8m^2 + 18m) \div (-2m) = \dfrac{-8m^2 + 18m}{-2m}$
$= \dfrac{-8m^2}{-2m} + \dfrac{18m}{-2m}$
$= 4m - 9$

17. a) **i)** $\dfrac{15n^2 + 5n}{5n}$

Use algebra tiles to form a rectangle with guiding tiles:
Arrange 15 n^2-tiles and five n-tiles in a rectangle with one dimension $5n$.



Along the left side of the rectangle, there are 3 guiding n-tiles and 1 guiding 1-tile.



So, $\dfrac{15n^2 + 5n}{5n} = 3n + 1$

ii) $-3r(4 - 7r)$
Use the distributive property.
$-3r(4 - 7r) = -3r(4) + (-3r)(-7r)$
$= -12r + 21r^2$

iii) $(-16s^2 + 4s) \div (-2s)$

Think multiplication.

$(-2s) \times \square = (-16s^2 + 4s)$

Since $(-2s) \times 8s = -16s^2$, and $(-2s) \times (-2) = 4s$

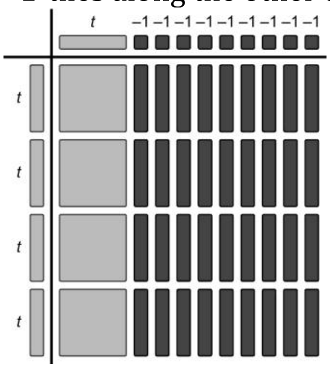
Then $(-2s) \times (8s - 2) = (-16s^2 + 4s)$

So, $(-16s^2 + 4s) \div (-2s) = 8s - 2$

iv) Use algebra tiles.

I can form a rectangle with guiding tiles: four t-tiles along one dimension, and one t-tile and nine

-1-tiles along the other dimension.



Four t^2-tiles and 36 $-t$-tiles fill the rectangle.

So, $(t - 9)(4t) = 4t^2 - 36t$

b) i) Alternative strategy: Write the quotient expression as the sum of two fractions:

$$\frac{15n^2 + 5n}{5n} = \frac{15n^2}{5n} + \frac{5n}{5n}$$

Simplify each fraction.

$$\frac{15n^2 + 5n}{5n} = 3n + 1$$

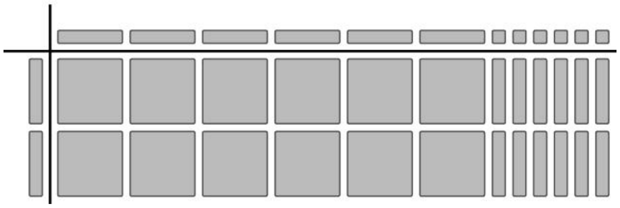
I prefer this strategy, since I can think of the division of each term separately, and make sure I have the correct signs. Or, I prefer the algebra tile model, where I form a rectangle with guiding tiles, because I can see the area and one dimension, and the answer is the number and type of tiles that form the other dimension.

iv) Alternative strategy: Use the distributive property.

$$\begin{aligned}(t - 9)(4t) &= (t)(4t) + (-9)(4t)\\ &= 4t^2 - 36t\end{aligned}$$

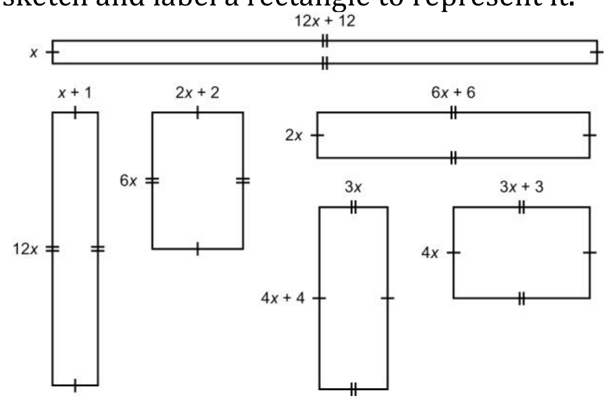
I prefer this strategy; I find it takes too much time to sketch the tiles, especially in this case, when you need 36 tiles. Using the distributive property is faster for me. Or, I prefer the algebra tile model, where I form a rectangle with guiding tiles, because I can see each dimension, and the answer is the number and type of tiles that fill the rectangle.

18. a) Arrange twelve x^2-tiles and twelve x-tiles in a rectangle with one dimension $2x$. The guiding tiles along the other dimension represent $6x + 6$.



$$\frac{12x^2 + 12x}{2x} = 6x + 6$$

b) Use guess and test and algebra tiles to make all possible rectangles that represent the polynomial $12x^2 + 12x$. Identify the dimensions of each algebra-tile rectangle, then sketch and label a rectangle to represent it.



$(12x^2 + 12x) \div x = 12x + 12$
$(12x^2 + 12x) \div 12x = x + 1$
$(12x^2 + 12x) \div 6x = 2x + 2$
$(12x^2 + 12x) \div 2x = 6x + 6$
$(12x^2 + 12x) \div 3x = 4x + 4$
$(12x^2 + 12x) \div 4x = 3x + 3$

21. I wrote each quotient expression as the sum of fractions, then simplified.

a) $$(12x^2 + 6xy) \div 3x = \frac{12x^2 + 6xy}{3x}$$
$$= \frac{12x^2}{3x} + \frac{6xy}{3x}$$
$$= 4x + 2y$$

b) $$\frac{12gh + 6g}{2g} = \frac{12gh}{2g} + \frac{6g}{2g}$$
$$= 6h + 3$$

c) $$(-27p^2 + 36pq) \div 9p = \frac{-27p^2 + 36pq}{9p}$$

$= \frac{-27p^2}{9p} + \frac{36pq}{9p}$

$= -3p + 4q$

d) $\frac{40rs - 35r}{-5r} = \frac{40rs}{-5r} + \frac{-35r}{-5r}$

$= -8s + 7$

e) $\frac{14n^2 + 42np}{-7n} = \frac{14n^2}{-7n} + \frac{42np}{-7n}$

$= -2n - 6p$

23. a) A cube has 6 congruent faces. Its surface area is 6 times the area of one face. So, to find the area of a face, I divide the surface area by 6:

$54s^2 \div 6 = 9s^2$

The area of one face is $9s^2$.

b) To find the edge length, I think multiplication.

$\square \times \square = 9s^2$

Since $s \times s = s^2$ and $3 \times 3 = 9$, then $3s \times 3s = 9s^2$

So, the edge length of an edge is $3s$.